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RETINITIS PIGMENTOSA.

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This report of twenty-five cases of rētinitis pigmentosa represents nineteen families. There were eighteen males and seven females which make the percentage of females twenty-eight per cent, which is about what is usually reported. The parents were related in twenty per cent, and were not related in twenty-four per cent. In fifty-six per cent no record of relationship is noted.

In two cases, eight per cent, mothers are known to have suffered from the same disease. Excluding the first and fourth families, where all the members were examined, there are eight families where the other children have ocular defects of some kind, but what it is not possible to state. It is presumably from the same disease, judging from the description given. In five families the records do not state the condition of the other members. In four cases, sixteen per cent, glaucoma occurred; in two of them in both eyes. In two cases, eight per cent, there were opacities of the posterior lens capsule. The history of the first three cases is remarkable as showing a tendency to glaucoma.

L. P. H., æt. 37, has had defective vision since he was eighteen years of age. He cannot venture out alone at night for fear of falling, and he is not able to distinguish a moonlight night from a cloudy one. Even by daylight he has difficulty in walking and

and is in danger of running against vehicles at the street crossings. June 25, '75, V. = $\frac{15}{XXX}$ with either eye, and reads Sn. $1\frac{1}{2}$ r. e. at 10″ and Sn. 1 l. e. at 10″. Field of vision very much contracted. At 24″ it measured 8″ vert. × 8″ horizontal. He was examined in 1871 but since then his vision has not perceptibly failed. He is partially deaf. The retinæ are moderately pigmented. The blood vessels are diminished in calibre and the papillæ are a shade whiter than normal. In 1876 and '77 he was again examined, and his vision for the distance found to be slightly less than in '75. His central vision was still quite good.

Jan. 16, 1886, he writes. "It seems to me that recently my vision has been declining more rapidly in proportion than that of my sister and brother, considering that I have the use of both eyes while they have but one each. Objects are getting more indistinct and shrouded in mist, and reading is much more difficult."

Case II. E. H., 35, sister of above. Eyes similarly affected, and the failure in sight was noticed about the same age. The right eye is glaucomatous and painful at times, and vision is reduced to bare perception of light. In the left eye the field of vision is markedly contracted, but the central vision is good and she can read ordinary print without trouble. She says her vision is steadily failing year by year. May, '75. V. = $\frac{20}{80}$ with $-\frac{1}{8}$. A year later in 1876, V. = $\frac{20}{80}$ with $-\frac{1}{7}$. Vision was the same but her myopia had increased.

In Sept. 1878. She had an attack of acute glaucoma of the left eye. She suffered severe pain and vision was very much impaired. I went to Columbus and with the assistance of Dr. Starling Loving made an irridectomy upward, which had the effect to arrest the glaucoma. I saw her a year or two later, and she still had vision enough to enable her to go around comfortably and read ordinary print.

In her case the retina was more pigmented than in her older brothers, and there was decided atrophy of the papilla and diminution in the calibre of the vessels. When I saw her last in 1880 the disk was white and all of the retinal vessels had disappeared except two small branches, one going upward and one downward. The appearance was remarkable, taking into consideration the fact that she still had a moderate amount of vision.

Like her brother she is quite deaf and has to be spoken to in a loud tone. At the present time, Jan. 1886, she is still able to read, but with some difficulty.

Case III.—G. W. H., 33, brother of the above, is a tall spare man, rather delicate in appearance, but enjoys good, if not robust health. He has vertigo occasionally, especially if he rises suddenly. He is unable to walk alone at night on the street, and even has difficulty in passing persons by daylight. His eyes have been defective since boyhood, but for several years have remained stationary. Sept., '74, V. = $\frac{15}{c}$ with either eye, and reads Sn. 4 at 10." Field of vision concentrically contracted. Examined again April, '75, V. = $\frac{15}{LXX}$, and reads Sn. 2 slowly at 6." Vision at this time is better than at the previous examination. This may have been owing to the difference of the light.

In April, '76, he had an attack of acute glaucoma in both eyes. Vision in left eye was reduced to seeing shadows of the hand downward and inward. With the right eye he could still read Sn. 4. Dr. Williams made an iridectomy in each eye upward, with the result of checking the glaucoma and saving a useful amount of vision. A month later he could read Sn. 2 at 4" r. e., but the left eye was not improved. Five months later vision was slightly better l. e. but r. e. unchanged. He still retains moderate vision in the left eye.

Family history. Parents are living and in good health. The father has perfect sight for distant as well as near objects. The ophthalmoscope shows no pigment degeneration of the retina. The mother is myopic about 6 D. Her vision is very good with the proper correcting glasses. I could detect no pigmentation of the retina. There were five children in the family. The eyes of the first three are described above. The fourth child died at the age of sixteen, and up to that time there was no appreciable failure of vision. The fifth, now a young lady of 26, was examined ophthalmoscopically and no retinal defect found. Her vision was perfect in both eyes. In the three cases reported above, vision began to fail at about the age of eighteen. The parents were not even remotely related.

Case IV.—G. B., 41, glaucoma absolutum, left eye T + 3, cornea hazy. Eye has been blind and painful for a year. It

was enucleated, and upon examination the retina was found to be strongly pigmented. The pigmentation extended from the periphery almost to the disk.

The right eye also presents the characteristic retinal pigmentation. Hm. $\frac{1}{10}$ V. = $\frac{15}{1}$ Sept., 1875.

The *H* was corrected and the eye gave him no trouble until March 7, 1883, when he was seized about 9 o'clock with excruciating pain in the eye. An examination the next morning revealed the fact that he was suffering from an attack of glaucoma fulminans. Vision was entirely abolished, the pupil was widely dilated and the pain intense. A liberal iridectomy upward was made at once by Dr. Sattler. The result of the operation was relief from the pain and a restoration of a very moderate amount of vision. He has three brothers and five sisters of whom one sister does not see well, but whether from the same cause is not known. His own children all have good eyes, with no evidences of retinal pigmentation.

Case V. E. G. P. 54 has had night blindness for twenty years. He is a carriage painter by trade. His field of vision is very much contracted. For a few years past this symptom has steadily increased and he often stumbles over objects in the shop. The pigmentation is well marked. In Jan. 1881, he had an attack of glaucoma of the right eye with intense pain. At present the pupil is moderately dilated. T. + 2 and V. = perception of light. In the left eye his vision = $\frac{6}{64}$ and he reads Sn 15 slowly.

Case VI. Mrs. C. C. æt 47. Sister has retinitis pigmentosa, but the pigment is very sparsely scattered over the retina. V. = $\frac{15}{30}$ r. e. and $\frac{15}{25}$ l. e. No apparent limitation in the field of vision.

They have a younger sister with defective eyes but cause is unknown.

The maternal grandmother had night blindness.

Case VII. Mrs. E. R. O., æt. 37, widow, gives the following history. She states that since she was a child she could not see well at night. Does plain sewing for a living, and does not experience much difficulty in the use of her eyes.

S. P. V. = $\frac{15}{25}$ and reads Sn 2 at 12″ with either eye. There

is a small opacity in the posterior pole of each lens. The veins are considerably diminished in size in both eyes.

The pigment is sparsely scattered over the retina, the greater portion being on the inner half.

She is the third child in a family of five children, and her parents were neither mediately nor remotely related.

CASE VIII. A. R. æt. 15, daughter of above, has eyes similarly affected. She has some difficulty in walking at night but can sew or read without difficulty. V. = $\frac{1}{2}\frac{5}{0}$ with either eye and reads 1 Sn at 12″, vessels slightly diminished in size. She has less pigment than her mother.

CASE IX. K. R. æt. 12, sister of above, has more pigment in the retina than either her sister or mother. V. is only $\frac{1}{5}\frac{5}{0}$ and reads Sn one with difficulty but Sn 2 readily. Has some difficulty in walking and more in reading at night.

CASE X. P. N., æt. 64, has glaucoma of the right eye, with the lens dislocated into the anterior chamber, as the result of an injury received fifteen years ago. Has seen tolerably well with the left eye until recently, when it began to fail. The ophthalmoscope revealed that he had incipient cataract, but through the striæ of the lenticular apacity could be seen the pigmentation of the retina. Has had night blindness since boyhood.

CASE XI. S. N., æt. 61, brother of above, has had night blindness since youth. He also has incipient cataract, but the pigmentation of the retina could be distinctly seen through the striæ in the lenses.

CASE XII. A. W. F., æt. 25, characteristic retinal pigmentation and F. very much contracted. Sight so imperfect that he is unfit for any ordinary work.

Family history.—Parents cousins, and mother in delicate health. He has three brothers and three sisters. All of his brother have such defective eyes that they cannot see to "plow a field or drive a reaper." One of his sisters has bad eyes, but the other two enjoy good sight. In the order in which they came the first and fifth child had good and all the rest imperfect eyes.

CASE XIII. L. M., æt. 31. Patient remembers that at ten years of age his vision was imperfect, as he could not see as

other boys did. He went to school and learned to read, but his sight failed so rapidly that at the age of seventeen he was no longer able to see sufficiently to read. Since that time vision has gradually declined, and is now practically nil. He has barely perception of light in l. e. and r. e. v.=0.

He has marked pigmentary changes in both retinæ, extending to the papilla in r. e. and almost to it in l. e. White atrophy of both papillæ; blood vessels very much reduced in size, and some of them obliterated.

Case XIV.—C. L., æt. 26, has noticed a gradual impairment of vision for some years. About seven years ago she was able to read newspaper print comfortably, but now only reads 8 Sn. at 10″.

Retinal pigment degeneration is very strongly marked, and extends beyond the equator of the eye.

Family history.—First and second children have good eyes; third, fourth and fifth defective eyes; sixth, seventh and eighth sound eyes. Patient is third child. Parents were cousins. Mother has good eyes, but father's sight very defective. She says he could not see to get about. F. contracted to about 8″ hor., by 9″ vert. at 24″.

Case XV.—M. V., æt. 12, retinitis pigmentosa in both eyes. V = $\frac{15}{LXIV}$ r, and $\frac{15}{XX}$ l. He is one of a family of ten children, three of whom have imperfect eyes. There is a history of remote consanguinity on the part of his grand parents.

Case XVI.—P. D., æt. 40, characteristic pigmentation of the retina in both eyes. F. contracted in both eyes, but vision for distance moderately good. The pigment is sparsely scattered in the retina. Failure in vision began about fourteen years ago. He is the youngest of seven children and has one brother with defective eyes. His mother has had imperfect sight for the past thirty years and is now almost blind.

Case XVII.—C. W. C., æt. 23, has well marked retinitis pigmentosa. Says his sight has been failing since he was 7 years of age. F. very much contracted, but is still able to read. Sn. 1½ at 12″. Decided atrophy of papillæ. Parents not related.

Case XVIII.—Miss C. B., æt. 30, has had failing sight for five years past, and vision is now reduced to quantitive percep-

tion of light. The pigmentation is abundant and there is marked atrophy of the disk and diminution of the calibre of blood-vessels. She is one of a large family of children, the balance of whom have good eyes. The parents have good eyes.

Case XIX.—H. D., æt. 17, is so amblyopic from retinitis pigmentosa that it is with difficulty that he can walk alone. He is the second in a family of four children and is the only one with imperfect eyes. In addition to examining the children I examined the parents and found their eyes free from disease of any kind.

Case XX.—S. C. V., æt. 44, has retinitis pigmentosa of both eyes with a small opacity on the posterior capsule of each lens. He is the fifth child in a family of nine children. Three children, the first, fifth and seventh, have defective vision. His father and mother were first cousins. He has an uncle and aunt who are first cousins, who have two children. One of them has defective sight, but he cannot tell how much it is impaired nor does he know the cause.

Case XXI.—W. G., æt. 38, has well marked pigmentation of the retina. His visual fields are markedly contracted. Says he had trouble while in the army seeing at night. Vision has very much diminished in the last three years, and he cannot see to walk alone. A sister who accompanied him had sound eyes.

Case XXII.—J. S., æt. 58, well marked retinitis pigmentosa in both eyes. V. $=\frac{6}{120}$ with either eye. Pigment very abundant. During the Mexican war first noticed that he could not see at night. His central vision, however, remained good enough to work at his trade (shoemaker) until three months ago, when it failed suddenly. Arteries small and discs pale.

Case XXIII.—W. A. S., æt. 44, marked retinitis pigmentosa. Typical pigment infiltration. He was first examined in 1873, when V. $=0.75$ with either eye. Family history.—Parents not related. His mother died at 66, and was blind for several years before her death with the same disease. His maternal grandmother is still living (1885), at the age of 89, and has been blind for many years. He says that the great-grandmother and one or two of her brothers were blind, presumably with the same disease. One of his mother's sisters and one brother

are nearly blind. Two of her sisters have good eyes. He has only one sister, and her eyes are free from disease of any kind. His second examination was in October, 1883, when vision was 0.2 r and 0.1+l. In October, 1885, he was examined again, and then vision was 0.3 r. and 0.1—l. The right eye seemed slightly better and the left eye slightly worse than they were two years before. His field of vision was reduced to the point of fixation. The pigment extended down to the disk.

Case XXIV.—T. J. R., æt. 33, characteristic retinitis pigmentosa, with greatly impaired vision.

Family history.—There are ten children in the family, seven girls and three boys. Four of the girls and two of the boys have ocular defects, presumably the same as those of the patient, who is the oldest of the family.

Case XXV.—W. H. R., aet. 25. Retinitis pigmentosa, with vision so much impaired that he only counts fingers at 7′ with either eye. No family history recorded.

Family.	Male.	Female.	Parents related?	Parents' eyes.	Children's eyes.	Glaucoma.	Post cortical opacities.	Remarks.
1.	2.	1.	No.	Mother very myopic.	Only one sister had perfect eyes.	Occurred in two of the three cases.		
1.	1.		Not stated,	Not noted.	Three brothers with good eyes Five sisters, one has defective eyes.	Both eyes.		His own children have sound eyes.
1.	1.	1.	Not stated.	Not noted.	No other children in family.	Glaucoma right eye.		Paternal grandmother had night blindness.
1.		3.		Mother's eyes affected.	Two daughters with retinitis pigmentosa		Post cortical opacities.	Father is dead; had good eyes.
1.	2.							Senile cataract in both cases.
1.	1.			Cousins.	Three brothers and one sister with defective eyes. Two sisters with sound eyes.			
1.	1.		Not stated.					
1.		1.	Cousins.	Father imperfect eye.	Eight children, three of them with defective eyes.			
1.	1.		Remotely related.		Ten children in family three of whom have imperfect eyes.			
1.	1.		Not stated.	Mother blind.	One brother with defective eyes.			

Family.	Male.	Female.	Parents related?	Parents' eyes.	Children's eyes.	Glaucoma.	Post cortical opacities.	Remarks.
1.	1.		No.					
1.		1.	Not stated.	Good.	Large family, all others with good eyes.			
1.	1.		No.	Good.	Four children, only one with diseased eyes.			
1.	1.		Cousins.		Nine children, three of whom have ocular trouble.		Post cortical opacities.	
1.	1.		Not stated.		One sister with good eyes.			
1.	1.		Not stated.					
1.	1.		No.	Mother had retinitis pigmentosa; also maternal grandmother and great-grandmother.	One sister with sound eyes.			
1.	1.		Not stated.		Seven girls and three boys. Four girls and two boys have ocular defects.			
1.	1.		Cousins.					
19.	18.	7.						

THE MECHANISM OF ACCOMMODATION AND A MODEL FOR ITS DEMONSTRATION.

B. ALEX. RANDALL, A. M., M. D.

In the January issue of the AMERICAN JOURNAL OF OPHTHALMOLOGY, Dr. Furney discusses this subject and urges the necessity of a new theory, because the older ones are incompetent to explain the facts. As his statement of these facts and of the Helmholtz theory is incorrect in several important particulars, it seems not out of place to venture a few words on this much discussed topic.

Passing over his first "fact" that accommodation is voluntary, to the strict accuracy of which exception might be taken, we learn from his third premise that *only the anterior curvature* of the lens varies in changes of the accommodation. Donders[1], Helmholtz[2], Knapp[3], Woinow[4], and others show the contrary, while holding that the *position of the posterior pole* remains unchanged; this being the result obtained by Cramer, although not conclusively proven by him. As to the correct theory of the accommodative mechanism, if, as would seem, that of Helmholtz is meant, this is far from accurately set forth in the statement, "the capsule of the lens is supposed to be varied in size, forcing the contents into a more or less spherical shape as its area is reduced by allowing it to contract upon itself, or its area is increased or extended by stretching." Although most authorities agree that the lens capsule is elastic, I know of none who ascribe to it any such elasticity as is above implied: on the contrary the essence of the Helmholtz theory is that this capsule is practically inelastic [That this is not a correct statement is proven by O. Becker, Graefe and Saemisch, Vol. 5, and by the editor's paper on healing after iridectomy, Knapp's Archive, Vol. 4, page 423 to 444. —EDITOR.] and of unchanging area. The geometrical property of

1. Donders, *Accom., etc.*, p. 15. 2. Helmholtz, *Phys. Optik.*, p. 122. 3. Knapp, A. f. O., vi., 2. 4. Woinow, *Ophthalmometrie*, p. 119.

the sphere, that it has the greatest possible volume for a *given area* of surface, then fully explains the tendency of the very elastic lens fibres to give to that body a form approaching the sphere, when released from tension upon its equator. However, as Dr. Furney assumes this constant area of the capsule as an essential of his theory, further discussion of it may be omitted. The action of the ciliary muscle as a "tensor choroideæ" Dr. Furney seems to regard as wholly hypothetical, in spite of the proofs of Vœlckers and Hensen, and the corroborative evidence of studies of the ciliary-body and the lens-margin in the living human eye, and he seems unaware of the "accommodative phosphene" of Czermack. To assume that a contraction of the ciliary muscles must alter the curvature ot the cornea is as wholly gratuitous as to claim a similar effect from the action of the external muscles or any one of them; or to assert that they must draw forward the bony bottom of the orbit in their contraction. The *pull* upon origin and insertion must in any such case be equal; but the *effect* depends entirely upon the relative fixity of the two points. We know that the choroidal insertion of the ciliary muscle moves and the choroid is drawn forward; while the most rigid scrutiny fails to detect any movement of the corneal margin,[1] unless a small portion of it is cut loose from all but its attachments, when it is drawn visibly inward by the contraction of the ciliary muscle.[2] Analogy also furnishes us with the fact that in birds and some other animals, where the strain upon the origin of the ciliary muscle is probably greater, all danger of corneal yielding is relieved by a reinforcement of the limbus by a bony ring. How far the drawing forward of the choroid and of the retina tends to compress the retina and vitreous, is a question that has received little attention. Full compensation is probably made by the change in the equator of the lens. Possibly this pressure is a partial explanation of the accommodative phosphene.

The observed facts, and the Helmholtz theory of the accommodative mechanism have been too often clearly set forth to need

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1. Helmholtz, *Phys. Optik.*, p. 112.
2. Hensen and Vœlckers, *Ueber die Mech. d. Accom.*, p. 25.

any detailed explanation here,[1] but a description of a simple working model, which I have used for its demonstration may not be amiss, since it furnishes a fair, if not complete, proof.[2]

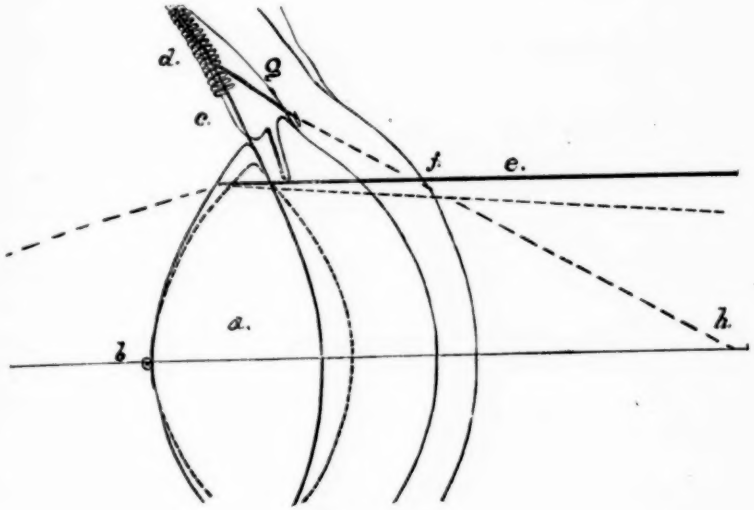

FIG. 14.

The outline of the crystalline lens in section is represented by a properly bent metal spring (a), the posterior pole (b) being fastened by a pivot to the foundation board of the model, on which the eye is sketched in outline. While tension is exercised upon its equator through the "suspensory ligaments" (c) by spiral springs (d). Rods (e) are fastened to the posteriar curve of the lens near the periphery to represent the rays of light for which the lens is adjusted. (These can be bent at (f), if desired, to represent the *corneal refraction*.) Cords (g) are attached to the spiral springs, and passing through the region of Schlemm's canal, converge on the back of the model to unite at (h). The rods (e) have a primary parallelism in the position of rest, and the eye then represents the emmetropic eye adjusted for dis-

1. Vide among others the writer's article in the Louisville *Med. Herald* Dec. 1880, p. 364.

2. A similar model has, I believe, been devised by Dr. Lucien Howe.

tance. Traction upon the cords (g) in the direction of the action of the ciliary muscle, relaxes the tension exercised by the spiral springs upon the zonula, the lens contour becomes more nearly circular, and the rods (e) converge and indicate the p.p. for which the eye is accommodating. The rigidity of a metal spring precludes a perfect representation of the delicate, flexible tissue of the eye, and limits the amplitude of the changes; but these none the less approximate to the actual variations as observed in the human eye, and this without the exaggeration of any of the elements of the problem, except for convenience, the unusual width of the pupil (8 mm, in the diagram, which is drawn to scale from the data of v. Jaeger and Knapp.)

It were needless to discuss the imcompetency of the *new* theory of the accommodation, even had it anatomical or physiological basis. Like the theory of active participation of the lens itself in accommodation, it had best begin by explaining why the lens is more convex after death than ever in life, why the vital "voluntary" act of accommodation is most vigorous in the dead eye.

THE PROLATE LENS OF DR. FOX.—MR. BORSCH'S SPHERO-CYLINDERS ON ONE SURFACE.

BY DUDLEY S. REYNOLDS, M. D., LOUISVILLE KY.

I confess to have read the first announcement of the form of the prolate lens described by Dr. Fox with some degree of incredulity. I have observed with increasing interest the various opinions expressed by gentlemen who had no facts upon which to base their criticisms. Dr. Fox did not claim to have observed the ordinary practice of directing his optician to construct a lens for the defect in his patient's eye. The demonstration of irregular astigmatism in an aphakial eye was of itself unusual. All the criticisms I have seen upon Dr. Fox's case have been confined to the presumed error of the major premise. To satisfy myself, I wrote some time ago asking Dr. Fox for a duplicate of his bi-cylindro-spherical lens for measurement. Shortly afterward I received from Mr. Borsch, the optician, a series of very remarkable lenses along with the now famous + 10 D s ⌒ + 3 D c 180° ⌒ + 2 D c 50° (ground in one.) I placed this glass in the clamp of my improved Snellen's phakometer, and registered indistinctly + $\frac{1}{2,1\text{-}2}$ 150° + $\frac{1}{3}$ 35° + $\frac{1}{3,1\text{-}2}$ 60°; or + 11 D 60° + 15 D 35° + 16 D 150°. The lines near their point of intersection on my registering disc cast halos upon the disc of the instrument. At a point corresponding very nearly with + $\frac{1}{3}$ sharp lines with halos surrounding in the two different meridians, separated at about 90°, appeared in the center. I then took + $\frac{1}{3,1\text{-}2}$ s ⌒ + $\frac{1}{11}$ c 50° and obtained perfectly clear lines. I was able to obtain clear, sharp lines in this combination, which measured + $\frac{1}{2,3\text{-}4}$ 140° + $\frac{1}{3,1\text{-}2}$ 50°. No intermedial focal point could be established. It was manifestly clear, the lens of Dr. Fox was not, therefore, a simple sphero-cylinder. Placing a stenopæic disc in contact with the surface of Dr. Fox's lens in the clamp of my phakometer, and revolving the disc upon the surface of the lens until the lines on the registering disc of the phakometer became clear, I developed precisely the

refraction represented by the figures in Dr. Fox's formula. Except that, I found one axis 35°; one 150°; and one 60°. I use the characters of the English scale in stating my first measurement of this lens, to harmonize the statement with the language of some of those who have made criticisms upon the subject, and who may not enjoy the advantage of lenses graded in this and the metrical systems.[1]

In the series of lenses sent by Mr. Borsch for my examination, is one with a perfectly plain surface, which measures + 12 D ⌒ + 10 D. Another ground upon one side only, the other being perfectly plain, measures + 6 D ⌒ + 2.50 D. Others vary, with concave sphero-cylinders ground upon one surface, sphero-cylinders ground upon one surface, the other surface being concave, to give periscopic form to the lens. One is a prism 10° ⌣ + 3 D ⌒ + 6 D. Plain periscopic cylinders, both plus and minus, are also supplied, constituting altogether a very remarkable departure from the ordinary methods of constructing lenses. The pendulum motion mentioned by Dr. Fox, must cut two surfaces of different radii, corresponding to the meridian of the axis of motion, and at right angles to this meridian, thus producing a bi-cylindrical surface. If on the other surface a sphere is ground, the axis of the cylinders will remain the same, but the character of the spherical surface opposite will modify their relations in the combination. Take a segment of a sphere two inches in diameter and set it on a pendulum an inch and a quarter long, this pendulum being set in motion would cut a curve in the direction of its motion representing the segment of a sphere two and a half inches in diameter. At right angles to the axis of motion the curve would remain precisely the same as that of the sphere represented by the cutting surface at the distal end of the pendulum. Without going into the details of the mechanism by which Mr. Borsch was able to execute the order of Dr. Fox for the bi-cylindro-spherical lens, the fact remains just as Dr. Fox stated it, except as to the axes of his bi-cylinders, as my measurements clearly demonstrate. For genuine novelty of

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[1] I use a set of lenses ground to order and graded by the English system, and a set of Nachet.

device, both Dr. Webster Fox and his optician, Mr. Borsch, are to be equally congratulated. From the tenor of Dr. Fox's letter to me, I infer he has directed samples of various forms of these new candidates for places in the trial cases of ophthalmic practitioners, sent to others for measurement. It is to be hoped that full reports of these measurements will be made public, for the purpose of definitely settling the various questions in dispute. I am especially happy in being able to state that the novelty of Dr. Fox's device has in no wise been impaired by the hasty criticisms of very many masters in ophthalmic science.

KERATO-IRIDO-DESCEMETITIS.

BY J. OSCROFT TANSLEY, M. D.,
Assistant Surgeon Manhattan Eye and Ear Hospital, New York City.

J. H., Norwegian, æt. 51 years; occupation, bookkeeper; residence, city. Was led into my office Dec. 15, 1881, and gave the following history: He had been troubled for about a year with asthma, and went, by advice, to the Adirondack Mountains early last summer. Never had any affection of the eyes before that November previous. While in the mountains his eyes began to annoy him by the sight being misty in the mornings, usually lasting until about noon, then becoming better in afternoon and evening—not the slightest pain or redness in or about the eye, only a slight itching upon lower lid, and this latter annoyed but a short time. Soon after the eye trouble began he came home and at once consulted his family physician, who said it was but a simple difficulty which would shortly wear off, probably thinking that no serious affection could attack an eye without causing it to be inflamed externally. The eyes continued thus without pain or injection, and normal in appearance. The mistiness or haziness of the sight continued every morning, but would pass away considerably by afternoon or evening, and then he could read by using both lenses of his ordinary reading eye-glasses over one eye. Upon Monday last he found that the usual afternoon clearing up was not sufficient to admit of his reading, and his condition has become daily worse. To-day R. V. = $\frac{1}{200}$. L. V. = $\frac{2}{200}$. No improvement with glasses.

Examination. Left eye. Cornea has a very peculiar dirty white or grey appearance, as though the epithelium was much thicker than normal, and opaque, somewhat the appearance of sugar frosting upon a cake, even so far as having the little points of depression, as though pins had been used to puncture. At one spot it has the appearance as though a piece of the epithelium had been scraped off with the finger nail, leaving

clear corneal substance. There are also punctate spots of greater opacity. Anterior chamber of normal depth. Pupil does not respond to stimulus of light and is about one-half dilated. Posterior synechia supero-temporally. Can get only a red reflex from fundus. Cannot even see where the disk is. When patient looks upwards and I look through the lower half of cornea, I cannot get a red reflex even. Tension *plus*. No circumcorneal injection or even enlarged veins of conjunctiva; palpebral conjunctiva slightly hyperæmic.

Right eye. Cornea has same epithelial opacity as left; also same small depressions as though a pin had been used to penetrate; also same spots of increased opacity. Anterior chamber normal in depth. Pupil gives no response to light, and has posterior synechia infero-nasally. . Nothing but red reflex from fundus, and no reflex when looking through lower half of cornea. Tension plus. No circumcorneal injection; slight palpebral conjunctivitis.

Atropia used, and thirty minutes afterwards left pupil was dilated well, but one synechia; right pupil dilates well nasally and, here one synechia, but temporally does not dilate well; think there may be large adhesions but cannot see sufficiently clearly to be confident, because of corneal opacity.

After atropine R. V. = $\frac{8}{200}$. L. V. = $\frac{10}{200}$. No syphilitic history.

I cannot make a positive diagnosis. It looks greatly like a chronic glaucoma, but the corneal opacity does not resemble that usually seen in glaucoma. It more nearly resembles interstitial keratitis, but the peculiar appearance of corneal epithelium I never have seen before. It seems purely a thickening or proliferation of epithelium with no hyperæmia; then the deep anterior chamber and posterior synechia are not like glaucoma, although the synechia may be a result of previous inflammation, but he cannot remember ever having had a conjunctivitis even, previous to his present trouble. The thickened condition of the epithelium could hardly have come with anything but a keratitis; still a keratitis without a circumcorneal injection is rare. The synechia and deep anterior chamber is probably the result of an iritis, Still, an iritis of sufficient importance to

cause adhesions is usually also accompanied by circumcorneal injection.

Viewing the case as a kerato-iritis of sero-plastic nature, with glaucomatous symptoms, I gave atropine, gr. iv ad ℥j, gtt-j. t.i.d. in eyes. Ung. hydrarg. as an inunction twice daily. Sat. sol. kalii iodidi gtt. x. t.i.d., increased daily two drops.

December 17, 1881. R. V. = $\frac{9}{200}$. L. V. = $\frac{10}{200}$.

Right eye. No redness; cornea clearer than when last seen; at temporal side there are the same spots where the epithelium seems to be absent, and where cornea is comparatively clear. Iris almost fully dilated excepting nasally at synechia. Can only get red reflex, and not this through the lower half of cornea. I can to day see the characteristic dark punctate spots on membrana Descemet, of serous iritis; they are very marked indeed, particularly at lower part—here they are almost a mass, which accounts for impossibility of getting a red reflex when looking through the lower part of cornea.

Left eye.—Epithelial opacity has become markedly thinner. Iris fully dilated excepting temporally at synechia. Same dark deposits upon Descemet's membrane seen here as in right eye, very marked, particularly in lower half. A little to temporal side of center of pupil is a shadow running downwards and inwards, seemingly in lens. Patient can now, after examination, easily read $\frac{20}{200}$ with either eye; he also says that yesterday he was able to read in the afternoon by aid of his glasses.

The cause of the morning blindness was undoubtedly the opacities in the aqueous which gravitated to the lower part of the anterior chamber in latter part of the day, leaving the pupillary center clear. Same treatment continued. December 22, 1881. R. V. = $\frac{20}{30}$; L. V. = $\frac{20}{100}$. Right eye. Corneal epithelium all clear to-day, some cloudy opacity in the lower part of the cornea evidently in posterior layers of corneal substance distinct from deposits upon Descemet's membrane, it being in an anterior plane and only dark from its opacity, and in certain lights looks light colored and seems to consist of numerous spots of opacities connected by threads of similar opacities, resembling very much interstitial keratitis. Descemet's membrane is covered with punctate dark spots, particularly the lower

half where they are still in mass; they can be seen to-day perfectly, because of the clearness of the corneal epithelium; they are evidently brownish spots of pigment upon inner surface of the cornea and not light colored in any illumination.

Synechia seems upon the point of breaking. Can see the fundus indistinctly, which appears normal.

Left eye. Corneal epithelium clear and normal. Corneal substance affected in posterior layers in the same manner described in right eye, but to a less degree. Punctate spots on Descemet's membrane very marked indeed, particularly on the lower half. Synechia posterior is more marked than in the right eye but is passing away. Fundus shows no evidence of any internal disease.

December 27, 1881. R. V. = $\frac{20}{20}$; L. V. = $\frac{20}{100}$. Has been using atropine in each eye six times a day, kalii iodidi gtt. xxx, t. i. d. and inunction of ung. hydrarg, once a day. Stomach not good for past few days, has had pain but no nausea. Gums not sore; has very poor teeth and it is somewhat difficult to tell when they are affected mercurially. Breath is mercurial, though not particularly so. He says that his sight is for distance apparently as good as ever; left eye was never as good as the right.

Examination. Right Descemet's membrane much clearer in upper half, but the lower is still largely covered with the deposits. Synechia much less than before, being now a mere thread of attachment. Fundus still seen somewhat indistinctly.

Left cornea almost entirely clear, only a few spots on lower half of Descemet's membrane. Synechia entirely gone. Fundus entirely healthy, may be slightly astigmatic.

Jan. 4, 1882. R. V. $\frac{20}{30}$; H. T. = + $\frac{1}{72}$; L. V. = $\frac{20}{100}$. E.

Right synechia not yet broken; Descemetic spots much less. Slight haziness in fundus, which I fear may not be entirely caused by the corneal troubles. Has had no evidences of mercurialization. Told to decrease the iodide to gtt. xv t. i. d.; increase inunction to three times a day, and, as his throat is quite dry, must decrease the atropine.

Jan. 10. R. V. = $\frac{20}{30}$ +; L. V. = $\frac{20}{100}$.

Right synechia not broken, still some slight blurring of the fundus.

Left cornea clear, only few spots to be seen; fundus clear and healthy.

I used atropine in the patient's eyes this morning, one drop every ten minutes for two hours. His throat became very dry indeed, and there was increased dilatation of the pupil, but no rupture of the synechia. Told to continue inunction three times a day, kalii iodidi gtt. x, t. i. d. and atropine as much as possible, and not have his throat too dry.

Jan 18. R. V. = $\frac{20}{30}$ +; L. V. = $\frac{20}{100}$.

Right, synechia not yet broken; very few Descemetic spots. Pupil widely dilated; fundus slightly hazy in parts, perhaps a little clearer than upon last visit.

Left, normal in every particular. Given eserine gr. jv ad. ℥i. gtt.j. in eye t. i. d. Inunction only once a day; iodide as before.

Jan. 22. R. V. = $\frac{20}{20}$; L. V. = $\frac{20}{100}$.

Both pupils considerably contracted; I used atropine to dilate pupil. I found the synechia in right eye not broken, and but few Descemetic spots remaining. Told to continue using eserine for two weeks, and, as he is anxious to return to and retain his situation, from which he has been absent for over a year, I have permitted him to begin his labors, but to use care in doing so.

Feb. 5, 1882. R. V. = $\frac{20}{20}$; L. V. = $\frac{20}{100}$.

The synechia of right eye not yet broken; told to continue eserine in this eye only.

Feb. 19. R. V. = $\frac{20}{20}$; L. V. = $\frac{20}{100}$.

Right pupil much contracted and circular; Descemetic spots but few, only three or four. I used atropine to dilate pupil and found synechia not broken, though much stretched and attenuated. Fundus clear and seems normal in every particular. It is evident that the synechia is so attenuated that any contraction or dilatation of pupil cannot draw upon or break it, and, such being the case, it can cause but little, if any trouble. Told to discontinue use of eserine and atropine; to continue inunctions and kalii iodidum for a time, and to see me when necessary.

This case is interesting because of its close resemblance to glaucoma in history and appearance. The peculiar epithelial opacity and deep anterior chamber being the only points in which, upon first examination, it differed from glaucoma. In

this particular it would certainly be a stumbling block to many practitioners, and for this reason it is worthy of study. It can hardly be called a serous iritis, because the iritic process was also plastic; it cannot be called simply a Descemetitis because there was also an interstitial keratitis and iritis.

It is also interesting because of there being a plastic iritis and a keratitis both interstitial and epithelial and at same time having no circumcorneal injection.

For these several reasons then, it would seem improper to call the case a serous iritis, but rather a non-inflammatory kerato-irido-Descemetitis.

CLINICAL OBSERVATIONS.

BY P. B. WALDMAN, M. D., READING, PA.

Case I.—Paresis of Inferior Rectus Muscle, Probably Reflex from Traumatism.

Mr. J. S., æt. 22 years, while at work received an injury from the "bursting of a flask," a large piece striking his right cheek and knocking out several teeth, numerous small particles flying into the eye. One hour after the injury the eye was cleaned by removing all foreign bodies, and in three days he was apparently well.

On the sixth day after the injury he presented himself again, stating that he saw everything double, the objects being one above the other, and that he could not work, owing to confusion of objects.

On examination with a lighted candle placed at a distance of twelve feet, the false image belonging to the right eye was below and to the left of image belonging to left eye, and they were about two feet apart. When the conjunctiva was grasped with a pair of fixation forceps and eyeball drawn downward the images became fused.

I performed a careful tenotomy of the superior rectus of right eye, which was followed immediately by single binocular vision. Now, about six weeks since tenotomy, the patient reports that the result has remained good.

Case II.—A Case of "Nuclear Paralysis" of the Third Nerve, Supplying the Exterior Muscles of the Eye.

I publish the following case, thinking it to be of some interest, as it presents such a clear picture of central paralysis.

John Hall, æt. 48 years, consulted me Dec. 20, 1885, giving the following history: On the night of Dec. 16, 1885, he retired perfectly well; in the morning on awaking he could not raise his left eyelid. No other symptoms.

Stat. præs. Complete ptosis; upon raising the lid, the eye is seen to be divergent. No motion directly upward or downward, slight motion down and outward (superior oblique) slight lateral motion, contraction and relaxation of external rectus. *Pupil and accommodation are intact*; size of pupil same as that of right eye, 4 millimeters, and active; reads Jaeger No. 1 at 8 inches with + 1 D. (Has worn + 1 D for near vision for four years.)

The lesion in this case is, no doubt, a central one, and not involving the centre for the intraocular muscles, which lies anterior to that for extraocular muscles (Kahler and Pick[1]), and thus explains the normal action of the pupil and accommodation.

The treatment in this case consisted in a free tenotomy of the external rectus, and hypodermic injections of strych. sulph. daily, commencing with one-fortieth of a grain and increasing to one-sixth of a grain. The result is a perfect cure.

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1. Mauthner's Vortraege, Heft XII.

REPORT.

The following report of a lecture on polarized light, delivered before the society of German Physicians of St. Louis, by Dr. C. O. Curtman, professor of chemistry in the Missouri Medical College, was kindly written for the JOURNAL by the lecturer himself. We think there is enough of interest in it to warrant its publication in our columns.—[EDITOR.]

At the meeting of the Verein deutscher Aerzte, April 2, 1886, Dr. C. O. Curtman read a paper on Polarized Light. After explaining the nature of polarization by reflection, by single and by double refraction, he made a number of experiments with the projection-polariscope. The production of complementary colors by double refraction and their union to white light was exhibited on the screen. The effects of position of polarizer, and analyzer to each other were shown in transmitting light when parallel and quenching it totally when crossed. Beautiful color effects were produced by interference of rays in crystals of quartz, selenite, benzoic acid, etc.

A Laurent-Mitscherlich instrument (*á penombre*) was then used to show the circular polarization of sugars, albumens, quinine, etc., and its application to the rapid analysis of glucose or albumen in urine, was tried by the members present.

Attention was especially called to some experiments described by Herschel, showing the utility of polarized light for signalling, so that only a party provided with an analyzing prism can read the signals. Also the application of the same method to the removal of the glare of reflection of polarized rays from surfaces of water, so that the observer with the analyzer can look deep down below the glistening surface. *Dr. Curtman proposes to employ the same method to overcome the annoyance of the glare of reflection from surfaces of water, from fields of snow or ice, and from the glass windows of sunny streets, by using thin transparent tourmaline plates, mounted in circular spectacle frames, so as to enable rotation of plates. His experiments proved that a printed page covered by a plate of glass, whose re-*

flection prevented a sight of the object below it, was easily read by means of a tourmaline adjusted so as to quench the polarized rays and to transmit only the ordinary light.

The introduction of such spectacles would prove valuable to pilots and others having to keep a sharp lookout on glistening surfaces of water; also to tourists and others whose eyes suffer from the irritating glare of reflected polarized light.

CORRESPONDENCE.

"36" OR "40".

The question raised by Dr. Coggin in the February number of this journal (page 50), regarding the equivalent of the metre-lens (*dioptrie*) in the series of glasses numbered according to the old system, admits of a positive answer.

The unit of the metric system (*dioptrie*) is a convex lens whose principal focal length is equal to one metre.

The unit of the old system, as determined by the usage of the French opticians and adopted in ophthalmic practice upon the authoritative recommendation of Donders, is a double-convex lens with radii of curvature, at its two surfaces, equal to one Paris inch.

As a rough approximation it is often assumed that the focal length of a lens numbered according to the old system is equal, in Paris inches, to the denominator of the fraction by which we express its value; this would be strictly correct if the index of refraction of glass were exactly 1.5 (3:2), and the formula of the double-convex lens would then have the very simple form, $\frac{1}{f} = \frac{2}{2r} = \frac{1}{r}$.

But the index of refraction of crown or plate glass is actually greater than 1.5, and varies, in different specimens, between the limits 1.517 and 1.542.

If we could select for the manufacture of spectacle lenses a plate glass of the index of refraction 1.541, taking the radii of curvature of the two surfaces of a double-convex lens equal to forty Paris inches, the resultant lens would have a principal focal length of 36.96 Paris inches, or one metre, which is equal to 39.37 English inches.

If the double-convex lens with radii of curvature equal to forty Paris inches is made of crown or plate glass whose index of refraction is 1.5326, substituting this value for μ (the index of re-

fraction) in the formula of a very thin double-convex lens, we obtain:

$$\frac{1}{f} = \frac{2\,(\mu\text{-}1)}{r} = \frac{1.0652}{40}$$

$$f = \frac{40}{1.0652} = 37.55 \text{ Paris inches} = 40 \text{ English inches.}$$

It is found by trial that the glass numbered $\frac{1}{40}$ according to the older French system has a focal length of about thirty-seven Paris inches, or very nearly forty English inches. The error in assuming $\frac{1}{40}$ as the equivalent of the metre-lens (*dioptrie*) is almost exactly .01575 *dioptrie* = $\frac{1}{2540}$; an error so small as to disappear in the presence of the far greater errors arising from differences in the refractive index of crown or plate glass from different manufactories, and from errors of observation incident to the most accurate measurements of the refraction of the eye.

In the glasses of European manufacture, as generally found in opticians' shops in this country, the focal length in English inches is expressed, without appreciable error, by the numbering of the glass; and the same is true of glasses of American manufacture, so far as I have measured them. The error involved in the adoption of $\frac{1}{40}$ as the equivalent of the *dioptrie* is at most only about one-fifth as great as it would be were we to adopt $\frac{1}{36}$. The suggestion to take $\frac{1}{36}$ as a special "American" *dioptrie* ought, therefore, not to prevail; by adopting it we should, moreover, set up a new standard, differing materially from that actually in use in Europe, and needlessly abandon the fundamental principle of metric uniformity.

JOHN GREEN.

St. Louis, March 1, 1886.

To the Editor of the American Journal of Ophthalmology:

DEAR SIR:—In the current number of your journal is a communication headed, "36 or 40; Which shall it be?"

In answer to this question concerning the real and nominal strength of lenses, a word or two from a manufacturer and importer will, I trust, be neither out of place nor unwelcome.

The answer is "40," for the following reason: Although the

greater bulk of fine lenses used in this country for the making of spectacles comes from Paris, those not ground on the metric system, are ground in *English* inches, which a comparison of the curved surfaces and focal distances of the lenses will readily demonstrate.

There are thirty-nine and thirty-seven one hundredths (39.37) English inches to the metre, so nearly "40" that the error in this approximation is less than a third of a dioptre in the strongest glass, the $+\frac{1}{2}$ and + 20 D differing by only .315 of a dioptre.

The fact that thirty-six (36.93) Paris inches make a metre, and that thirty-six may be divided into more convenient aliquot parts than forty has nothing to do with the question, as long as spectacle lenses as a commercial article are *not* ground in Paris inches.

If Dr. Coggin has a Roulot case in which 1 D is stronger than a lens of thirty-six American inches, it only confirms the opinion that Roulot's cases are not particularly reliable.

The writer has reason to believe that a supply of *American* test cases, accurately made in accordance with either of the well known standards, would soon follow any demand for such cases.

E. B. Meyrowitz.

New York, March 6th, '86.